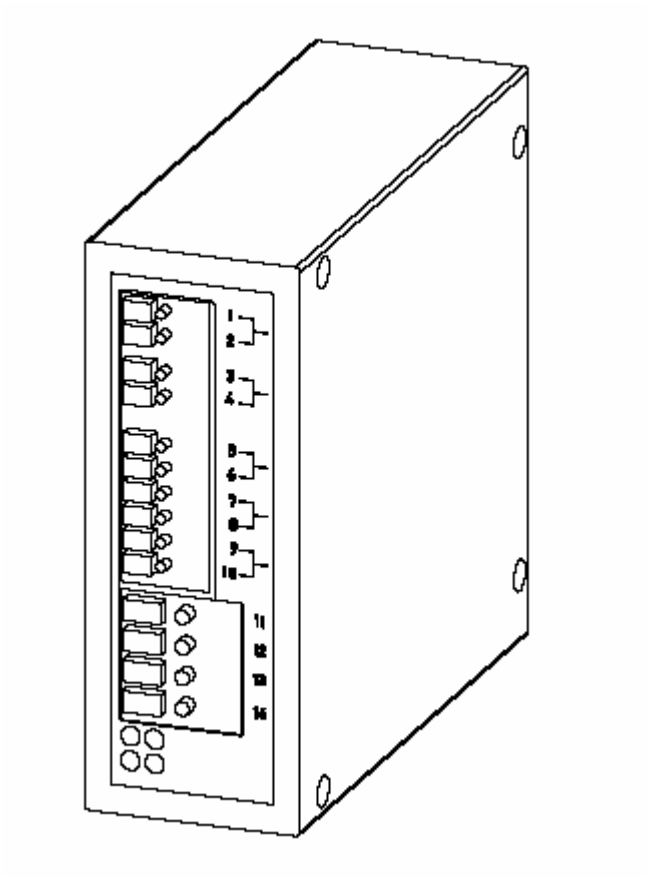
Brake monitor BCU2001



Assembly and operating instructions

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Notes on these assembly and operating instructions

Instruction obligation

These operating instructions must be read carefully by persons working with or on the BCU2001 before the BCU2001is assembled and used for the first time.
The user or operator of this device is under obligation to make these operating instructions available in full to all persons using, maintaining or carrying out any other work on this device.
These operating instructions form an integral part of the BCU2001

Validity

These operating instructions are in accordance with the technical state of the art of the BCU2001 at the time of issue. The contents do not constitute part of the contract but serve as information.
Pintsch Bamag reserves the right to amend the contents and carry out technical modifications with regard to the details set out in these operating instructions without prior notification. Pintsch Bamag cannot be held liable for any inaccuracies or inappropriate information contained in these operating instructions as there is no obligation to constantly update these operating instructions.

Loss of guarantee

Our deliveries and services are based on our general conditions of sale (AVB) for deliveries and services. However, we reserve the right to amend the details in these operating instructions, in particular the technical data, operation, the dimensions and weights. Complaints about delivered goods must be submitted within two weeks of receipt of the goods accompanied by the delivery note. Subsequent complaints cannot be taken into consideration. Opening the housing or damaging the inspection seal result in immediate loss of guarantee.

Use

These operating instructions for the BCU2001 have been drawn up so that all the working stages required for assembly, operation and maintenance are described and can be carried out by trained electro-technical specialist personnel. The safety instructions must be observed.

Service

Our service information department is at your disposal in the even of any questions relating to the assembly, operation and maintenance of the BCU2001. The contact numbers and address are set out on the page 27 in the appendix.

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1 General

These operating instructions apply to the following products:

Brake monitor	BCU 2001	PB no. 008 066 000-249
	BCU 2001-20A	PB no. 008 066 001-249

2 These operating instructions ...

... explain the procedures for operating the BCU 2001 and contain information on safe

- Installation
- Commissioning
- Maintenance

The safety information for using the BCU 2001 is summarised in a separate chapter.

These instructions should be read prior to installation of the BCU 200. Familiarise yourself with the operation of the BCU 2001 and carefully observe the safety regulations

… address:

- Workshop fitters
- Maintenance personnel
- Operators

… use the following symbols:

∆ **Safety information is emphasised by a light triangle**
- indicates lists
- \- stands for working steps to be carried out by you

3 General product information

The BCU 2001 brake monitor is an electronic device designed for control cabinet installation, which by measurement of the current and voltage of the outgoing two-wire circuit, detects the operating state of a remote electromagnetically released spring-operated brake. As the device also detects brake lining wear, it fully replaces the micro switch or inductive sensor arranged in the brake for monitoring the air gap. This also obviates the need for signal cables from the brake to the control cabinet.

The BCU 2001 brake monitor is suitable for all sizes and types of brakes available from Pintsch Bamag and all standard coil voltages, irrespective of whether the voltage is delivered from a DC system or an AC system with subsequent bridge rectifier or one-way rectifier with freewheeling diode.

The auxiliary voltage for supplying the electronics can be a DC or AC voltage between 24 ... 110VDC and 24 ... 230VAC, 50/60Hz.

4 General safety information

The safety information provided here is of a general nature. Special safety information is provided at the start of a chapter or appropriate point in the text. All safety information should be observed in order to prevent accidents and damage to the BCU 2001.

The safety requirements must also be observed under pressure. Accidents cannot be reversed.

∆ Do not act negligently

Any actions that affect the safety of the BCU are forbidden.

∆ Only qualified electricians

Only qualified electricians may connect and test the functions of the BCU observing all safety measures.

∆ Use undamaged devices

Devices which exhibit visible damage must not be used.

∆ Isolate

Disconnection from the supply must be ensured before carrying out any work on the electrical system.

When disconnecting a cable carrying brake current, a dangerous voltage can occur on account of the high coil inductance, even with a low rated coil voltage (24V)!

Under no circumstances must the signalling state of the LEDs in the device be used as a means of verifying safe isolation from the supply.

∆ Do not switch on

Before connecting the BCU, the power supply must be disconnected.

- Place “Do not switch on” sign at the switching points.
- Set the BCU 2001, see Section “Installation”.
- Establish electrical connection.
- Remove sign.

∆ Passing on of documents

If the BCU 2001 is transferred to others, these operating instructions must be passed on to the recipient.

∆ Do not open device

The device must not be opened. For this purpose, the device is provided with a seal that is damaged if an attempt is made to open the device. The seal cannot be removed without being damaged. ***If the seal is damaged, all claims against the manufacturer will cease to apply***

Fig. 1: *Quality seal*

The quality seal can be in various colours. The colour is of no significance to the user.

Δ Abnormal device behaviour
Devices that operate abnormally must be switched off and replaced.

Δ Avoid working alone if possible

5 Terms

Brake: Electromagnetic spring-loaded brake which serves to brake the rotary movement of a drive shaft and/or stop rotation when at rest.

One-way rectifier (EGL): Type of rectifier with which only one sinus half-wave of the applied network alternating voltage is rectified.

Bridge rectifier: Type of rectifier with which both sinus half-waves of the applied network voltage are rectified.

Magnetic coil: Inductivity which serves to overcome the force of the springs through electromagnetic induction, i.e. moving the armature plate in the direction of the coil body.

Armature plate: Mechanically movable brake component which is moved by way of magnetic and spring forces. The force of the spring pushes the armature plate against the friction lining of the brake, the magnetic force counteracts the spring force.

Spring force/magnetic force: The mechanical force resulting from the number of springs in the brake. The force required in the magnetic circuit through electromagnetic induction to overcome the spring force.

Connecting the magnetic coil: The magnetic coil is activated through the application of an electric voltage, i.e. by way of electromagnetic induction the resulting current flow causes the armature plate to move towards the coil body. The brake is released and a drive shaft is released for rotation.

Disconnecting the magnetic coil: The magnetic coil is deactivated by disconnecting the electrical voltage, i.e. the mechanical spring force overcomes the electromagnetic induction force and the armature plate moves towards the friction lining plate. The drive shaft can no longer rotate and the drive shaft comes to a definitively fixed stop.

Protection circuit: The varistor contained in the protective circuit limits the high counter-voltage occurring during disconnection of the magnetic coil in a defined manner and brings about rapid depletion of the coil current.

6 Product description

6.1 Mode of operation

The mode of operation is based on the physical principle of a voltage or current being induced in the coil by the armature plate moving in a magnetic field on activation and deactivation of the brake, thus varying the time characteristic of the electrical quantities. If the armature plate moves against the spring force towards the coil body (releasing of the brake) when supply voltage is applied to the coil, the voltage induced in the coil is opposed to the driving voltage. This causes a change in the direction of flow of the current. For the duration of the motion, the current reduces and increases again on completion of the motion, to then reach the final value limited by the coil resistance. On disconnection of the supply voltage, the flow of coil current cannot stop abruptly. The coil inductance drives it under the build-up of a correspondingly high voltage across the protective circuit (varistor, active voltage limiter) arranged in parallel with the coil, as a result of which it quickly decays.

If the spring force now overcomes the magnetic force and the armature plate moves against the friction lining plate, this induces in the coil an additional current flowing in the same direction, i.e. the coil current increases until the motion is completed to then reduce completely to zero.

The analogue operational amplifier-based measuring, differentiating and evaluating circuit for coil current and coil voltage is able to exactly sense the discontinuity occurring during attraction and release of the armature plate and thus detect the actual position of the armature plate. It energises a relay when the armature plate is attracted and allows it to drop out at the same time when the armature plate is released. The operating state of the relay therefore represents the operating state of the brake.

In a second evaluating circuit it is determined whether on applying the voltage, the armature plate has moved to release the brake before the current reaches a value preset via coding switches (DIP switches S1). The current necessary to attract the armature plate with the largest permissible air gap is set. If the brake is released before the coil current reaches this value, the switching operation is without fault. If, by contrast, the set current limit is exceeded without previous detection of the brake being released, a fault (error) is present, which can have one of the following causes:

- **The maximum permissible air gap has been reached**
- **The armature plate is blocked**
- **The coding switches are incorrectly set**

In the event of a fault, a second relay, which picks up in a zero fault condition, drops out and remains in this condition as long as the auxiliary voltage for supplying the electronics is present. The interlock can also be cancelled via a button on the front panel.

The contacts of both relays are gold-plated and therefore suitable for direct signal output to an SPS. These contacts can also be used for a rated AC voltage up to 230V and for switching currents up to 2A. However, the gold plating is then destroyed and the contacts are subsequently no longer usable for low switching currents.

Of the relay contacts, the normally-open contacts are led out in each case. Available are three connections each with two terminals of the same potential, namely for the common incoming lead and both outgoing leads for **"Brake released"** and **"Fault"** status signalling.

6.2 Mechanical structure

The electronic circuitry is accommodated in a 45 mm plastic housing for fixing to mounting rails with an overall length of about 145 mm and a height of about 120 mm. The terminals are screw-type terminals and are located on the front side. Terminals 1 to 10 in the upper part are able to accept wire cross-sections up to 2.5mm^2 and are intended for connection of the auxiliary voltage and signal cables. Provided for each potential are two terminals internally interconnected for further wiring to other devices in the control cabinet. Provided in the lower part of the front panel are four individual terminals each capable of accepting a wire cross-section of up to 4mm^2.for connection of the brake and connection to the supply system. The circuit diagram is printed on the left-hand side of the housing.

Arranged below the terminals on the front panel are three LEDs for status display and a resetting button. The upper blue LED lights up when the fault relay has dropped out. The fault signal can be reset with the button arranged next to it on the left-hand side. The green LED arranged below indicates that auxiliary voltage is present and the brake monitor is operational. The yellow LED arranged next to it on the right-hand side indicates the operating state of the brake, i.e. the brake is released when the LED is illuminated. See also table 1.

For setting the brake monitor to the maximum permissible operating current of the brake to be monitored, located on the underside and protected in the housing is a switch unit with eight small coding switches (DIP switches). These switches must be set once to the switch combination characteristic for the respective brake prior to initial use, as specified in Section 9.

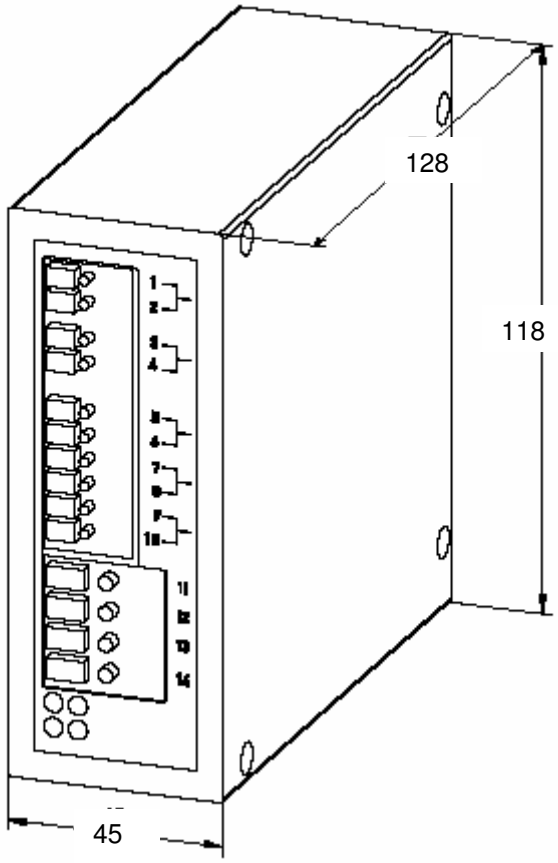

Fig. 2: *Dimensions*

6.2.1 Status indications LED

The status indications of the BCU 2001 set out in table 1 relate both to correct and faulty functioning of the brake. Sections 6.1 and 6.2 can be used to supplement the explanation in table 1.
The status for a blue LED or blue LED in combination with yellow LED as set out in the table signals a fault condition. However, with regard to servicing the brake a distinction must be made between the significance of the two statuses. As shown in table 1 possible fault causes can be considered if the blue LED (Service) is illuminated. .

In this event Pintsch Bamag or its authorised representative must be contacted for servicng and fault rectification.

Status indications LED	Explanation and possible causes
green LED	Auxiliary energy supply voltage applied to connection terminals 1/2 und 3/4.
yellow LED (Released)	After connecting the operating voltage the switch status of the brake is signalled. Yellow **"ON"** means: braked released Yellow LED **"OFF"** means: brake engaged, function of the brake OK
yellow LED (Released) **+** **blue LED (Service)**	The brake is released, but the maximum permissible air gap has been reached (Friction lining plate max. worn) Service due but not immediately necessary.
only blue LED (Service)	• Maximum air gap exceeded. Armature plate no longer holds. Risk of destruction of the brake if operation continues. **Service imperative!**
	• Armature plate blocked. Cause: e.g. Hand lever operated Cause: e.g. Manual release screws not loosened
	• DIP-switches S1 incorrectly set for the relevant brake type.
Button (Reset)	Blue LED can be reset with the button.
No **yellow LED (Released)** **+** **No** **blue LED (Service)**	If the BCU2001 after turning on the brake evaluates no signal of both conditions, yellow LED and blue LED, a functional examination must be executed. For this it is required to put the DIP switches to setting therefore: **0000 0010** If no blue LED takes place after the repeatedly turning on of the brake, a defect of the device is present and must be exchanged. **Indication:** The function of the BCU2001 can be tested generally with this method also during maintenance.

Table 1

6.2.2 Correct use

- Operation of the BCU 2001 serves only for monitoring the KFB and SFB brake series. Other brakes on request.
- The BCU 2001 serves for monitoring the brakes specified in Section 6.
- For use within the European Economic Area, the brake system and auxiliary power supply must be supplied from power supply systems with their own supply transformer for use on medium or high-voltage systems.
- The BCU 2001 serves only for brake monitoring purposes. The use of an external rectifier for supply from AC systems, overvoltage protector and switching element are additionally necessary.
- Only one brake may be connected to one BCU.

6.2.2.1 Assembly

The connection diagram for the BCU 2001 is printed on the housing. The principal circuit diagrams in the operating instructions serve as further help.

- The BCU 2001 must be installed in a control cabinet or similar on NS 35 mounting rails according to EN 50022 in such a way that the buttons and LEDs are visible from the front. The side with opening for the DIP switches must be located at the bottom.
- The mounting rail must be earthed in compliance with the locally applicable regulations.
- For wiring the brake circuit, cables with a voltage strength of at least 700V must be used, even when the braking voltage is only 24V.
- The cross-section must match the maximum brake current.
- The BCU 2001 has double supply voltage terminals and relay outputs for easier connection of several BCUs. The auxiliary power cable must be externally fused. The maximum fuse rating is 10A.
- The auxiliary power and brake circuit terminals must be tightened with 0.4 Nm and 0.5 Nm.

- Perfect functioning is only ensured when the brake monitor detects the actual coil current. Therefore, no electrical loads, even if they are highly resistive must also be measured. For this reason, the required overvoltage protection (varistor) must not be installed in the brake terminal box, but must be connected in the control cabinet upstream of the brake monitor, i.e. parallel with terminals 11 and 14.

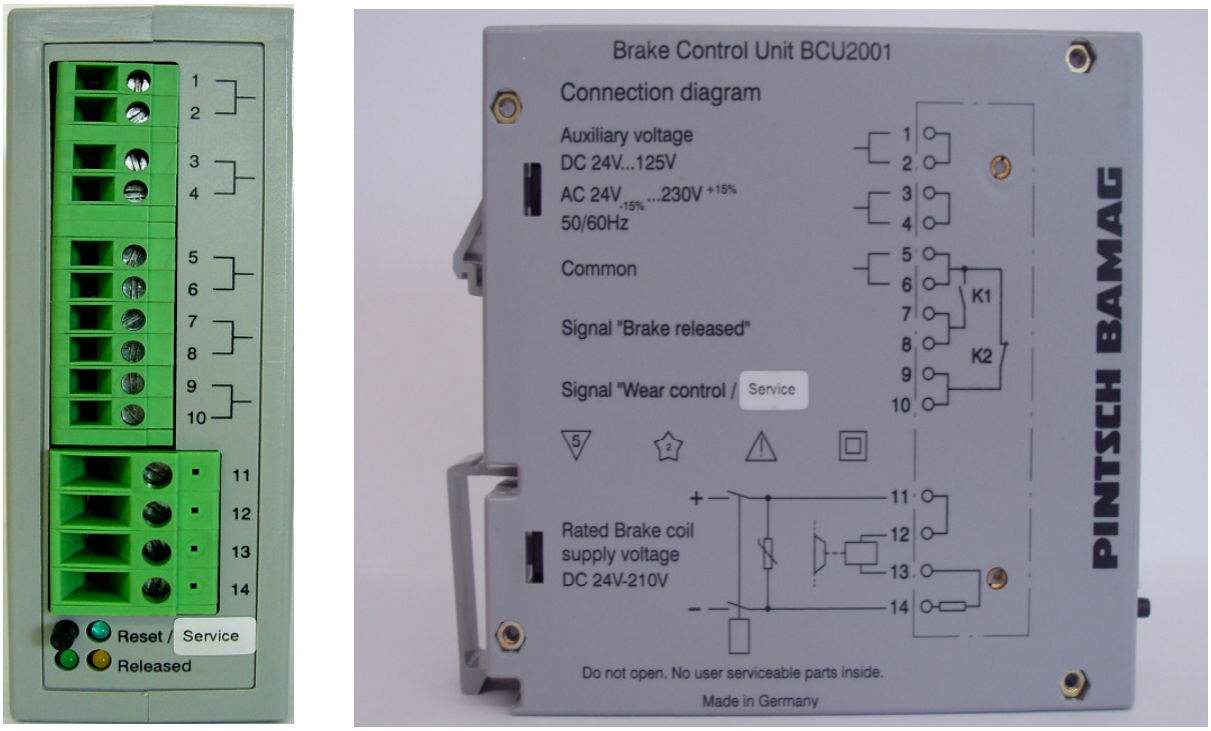

Fig. 3: *BCU 2001 in operating position (front viewt) with lateral connecting diagram*

Terminal	Bridged with	Function
1	2	Auxiliary energy incoming L or positive
2	1	Auxiliary energy outgoing L or positive
3	4	Auxiliary energy incoming, N or negative
4	3	Auxiliary energy outgoing, N or negative
5	6	Relay output, joint contact
6	5	Relay output, joint contact
7	8	Signal brake released (normally open contact)
8	7	Signal brake released (normally open contact)
9	10	Signal error (normally closed contact)
10	9	Signal error (normally close contact)
11	-	Brake supply, positive
12	-	Brake coil (positive)
13	-	Brake coil (negative)
14	-	Brake supply, negative

Table 2

6.2.2.2 Typical applications

Monitoring brakes in
- Container cranes
- Ship winches
- Automatic racking systems
- Conveyor belts

Service

If in doubt, contact Pintsch Bamag to see whether the BCU 2001 is suitable for your particular application.

6.2.2.3 Switching to the DC or AC side

To activate the magnetic coil a DC voltage is necessary. The power can be supplied via rectifiers from an AC or AC power network.
Figs. 4 and 5 show a principal circuit diagram for the voltage supply from an AC network with a bridge rectifier.

Principal circuit diagrams:

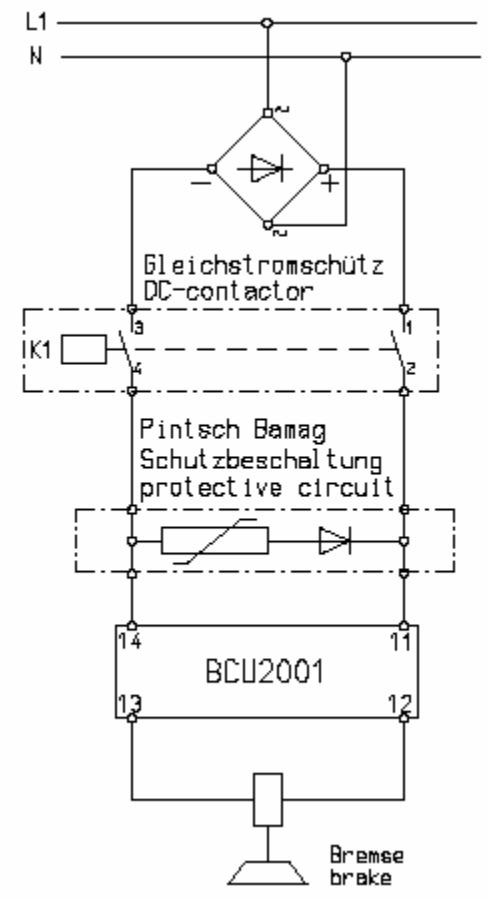

Fig. 4: *Switching to DC side*

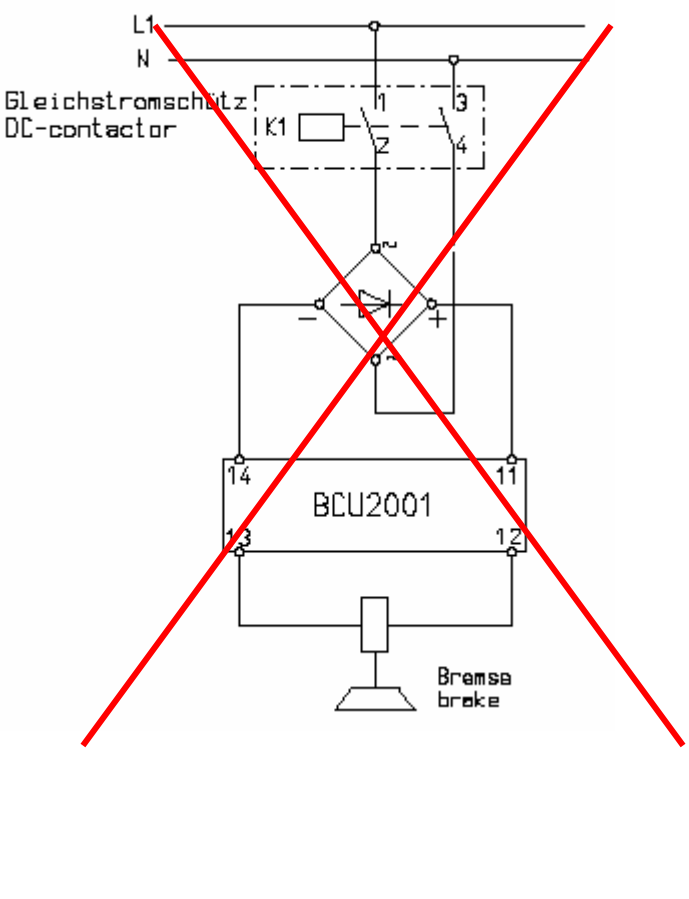

Fig. 5: *Switching to AC side*

With the combination from BCU2001 and brake must be switched on the DC side (Fig. 4). The boarding of the brake in combination with a BCU2001 may not take place on the AC side (Fig. 5).

When switching to the DC side, the contactor contacts must be suitable for switching inductive loads. The protective circuit serves as excess voltage protection when disconnecting the brake.

6.2.2.4 Supply from a three-phase current network

The brakes can be supplied from a three-phase current network. In this case the brakes must be wired in accordance with fig. 6.

Principal circuit diagram:

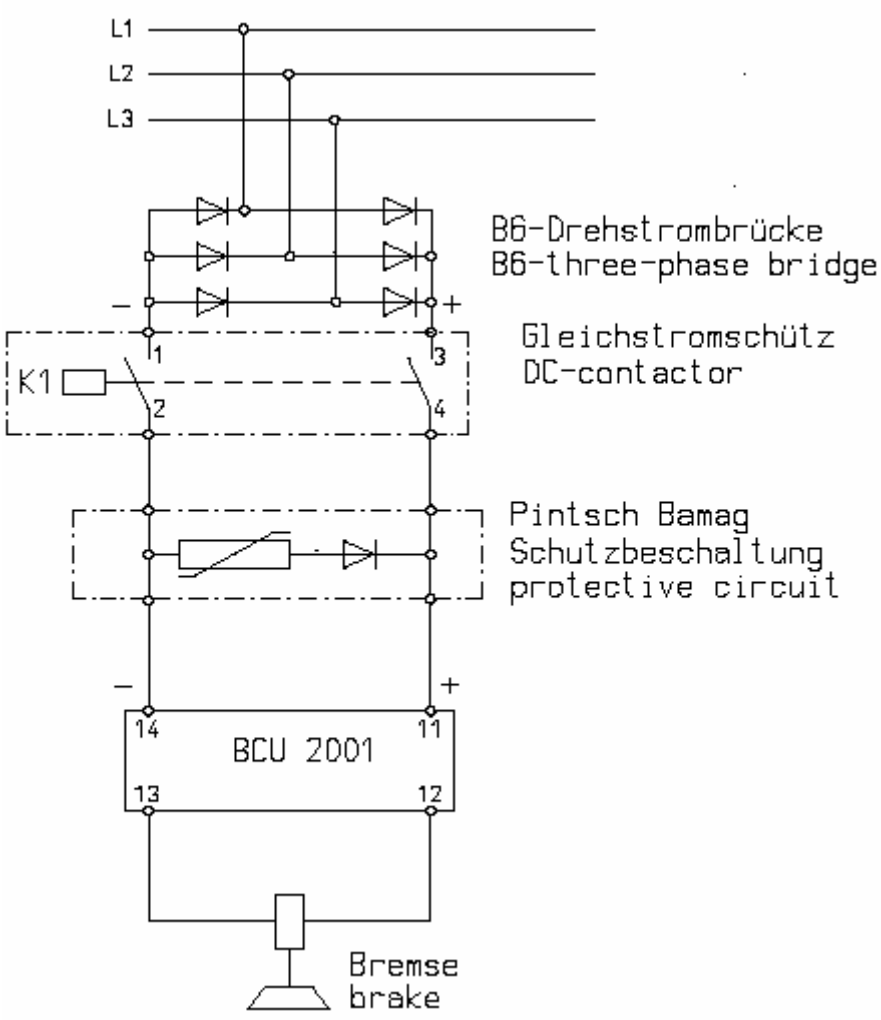

Fig. 6: *Supply from a three-phase current network*

When planning the installation the design of the DC contactor relates to the type of brake to be switched. The switching capacity of the DC contactor must be such that it can switch the resulting disconnection power of the brakes.
Otherwise, as a result of the arc effect at the protective contactor, rapid ageing occurs which eventually leads to destruction.

6.2.2.5 Voltage supply through brake modules BGL and EGL

The brake can be supplied from the AC network via the Pintsch Bamag brake modules with built-in protective circuit 1-4. These can be selected from the following brake modules:

1) EGL-S20K275
2) EGL-PE-400/150/5
3) BGL-S20K275
4) BGL-PE-400/150/3

The brake module technical data must be observed in order to prevent their destruction. Technical information about the brake modules can obtained on request from the current data sheet or the accompanying operating instructions. Figs. 7 and 8 show the principle behind the circuits of the brake modules for BGL and EGL versions and this must be observed. As switching can take place to the DC side and AC side simultaneously, the brake can be switched via a more cost-effective three-phase current contactor instead of a DC contactor.

Principal circuit diagrams:

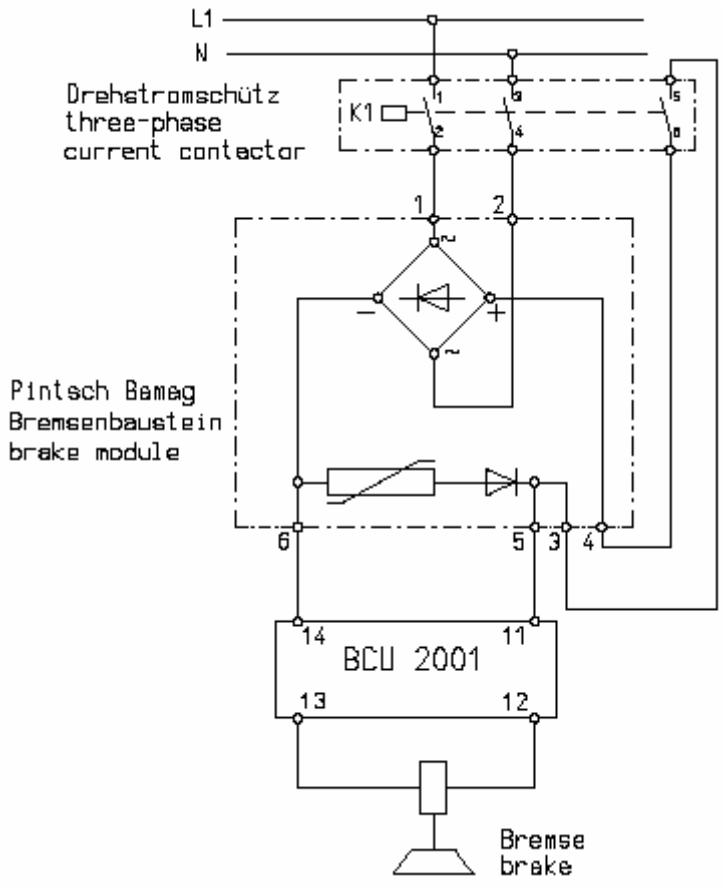

Fig. 7: *BGL with three-phase current contactor*

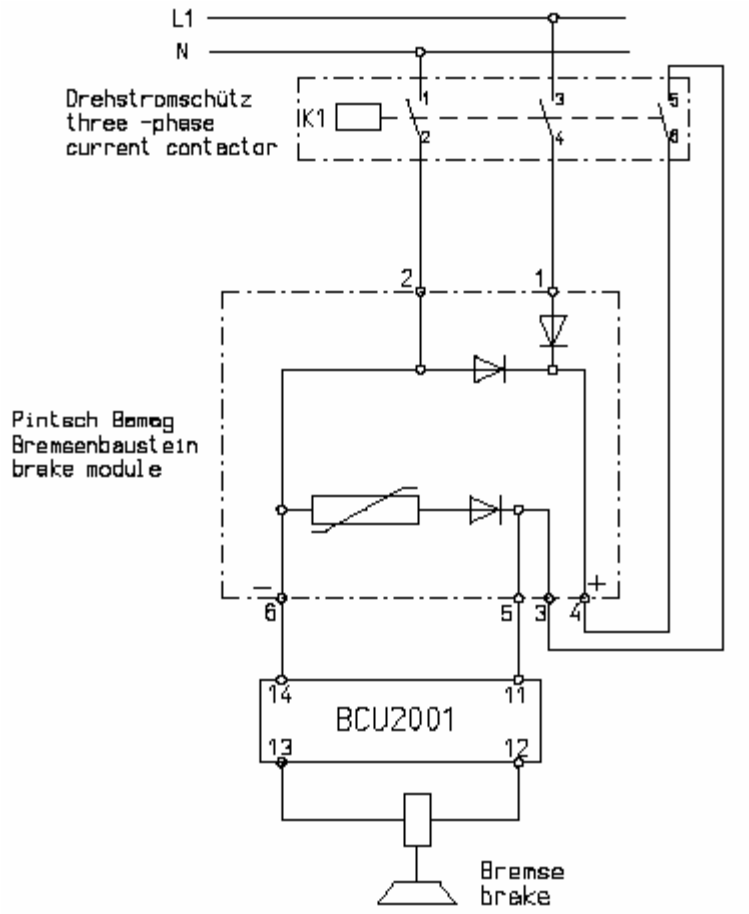

Fig. 8: *EGL with three-phase current contactor*

For choosing the right three-phase current contactor is the following criterion to attend. The contactors have to be able to switch the 2,5 times DC-brake current. Otherwise, as a result of the arc effect at the protective contactor, rapid ageing occurs which eventually leads to destruction.

6.2.2.6 Operation with switching rectifier SGL

The BCU2001 can also be wired in combination with a Pintsch Bamag switch rectifier and integrated protective circuit. The device switches electronically from bridge rectification to one-way rectification. Through selection of the coil voltage rapid release or application of the brake can be achieved. Fig. 9 shows the corresponding principal circuit diagram. Further information about the function of switch rectifiers SGL can be found in the current assembly and operating instructions or requested from Pintsch Bamag.

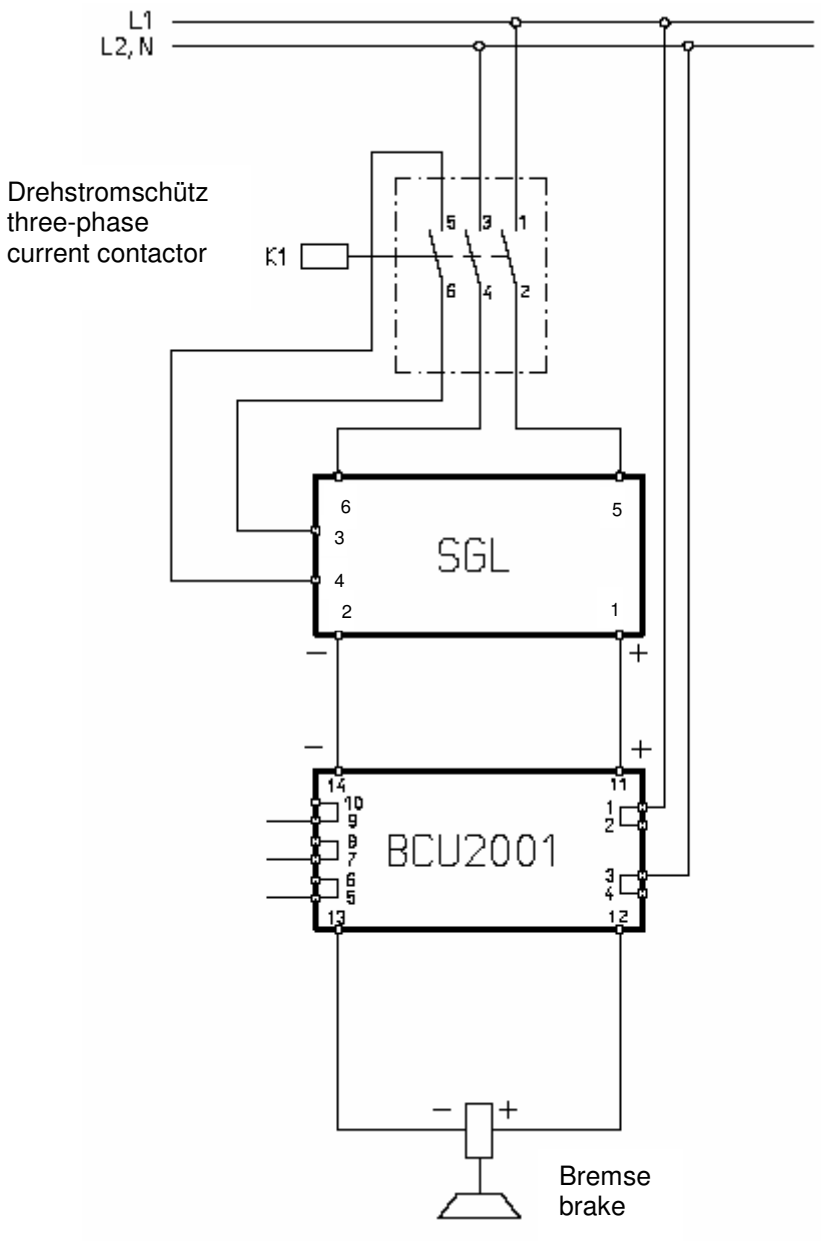

Fig. 9: *Combination of BCU2001 and switch rectifier SGL*

For commissioning the combination of BCU2001and SGL Pintsch Bamag must always be contacted. Depending on the brake type the switch-over time must be clarified using the SGL operating instructions and the DIP switch setting on the BCU2001. The appended table of DIP switch settings on the BCU2001 cannot be used in this case.

6.2.2.7 Parallel operation of brakes

The parallel operation of several brakes is possible.Fig.10 shows how each brake must be assigned its own BCU 2001 with parallel connection to terminals 11 and 14 of the BCU 2001. Also by supplying from a brake module BGL or EGL on Fig. 7 or Fig. 8 many in parallel connected brakes can be operated, as long as the technical data must be observed.

In contrast to disconnecting one brake, when disconnecting several brakes a greater current flows and the disconnection power is greater. Both are dependent on the number of brakes connected in parallel. As the operation of the rectifiers and brake modules is limited to a maximum current, the overall current of the parallel circuit must be taken into account. The maximum overall current flowing in the parallel circuit must be related to a cold magnetic coil in the design of the rectifier or brake module. The technical data of the circuit elements must be observed when connecting brakes in parallel, otherwise a fault could quickly occur so that correct operation of the brakes is no longer guaranteed.

In the parallel connection of brakes a protective element with spark quench properties is always required. For correct functioning of the BCU2001 when brakes are connected in parallel, the minimum number of protective element set out in table 3 is required. The exact number must be taken from the operating instructions for the protection element PE-400/150/5.

The parallel operation of several brakes in the case of AC-side switching in combination with a BCU2001 is <u>not</u> permitted.

Number of parallel brakes	Minimum number of parallel protection elements PE-400/150/5
2 - 4	1
5 - 6	2
7 - 8	3
9 - 10	4
11	5
12	6

Table 3

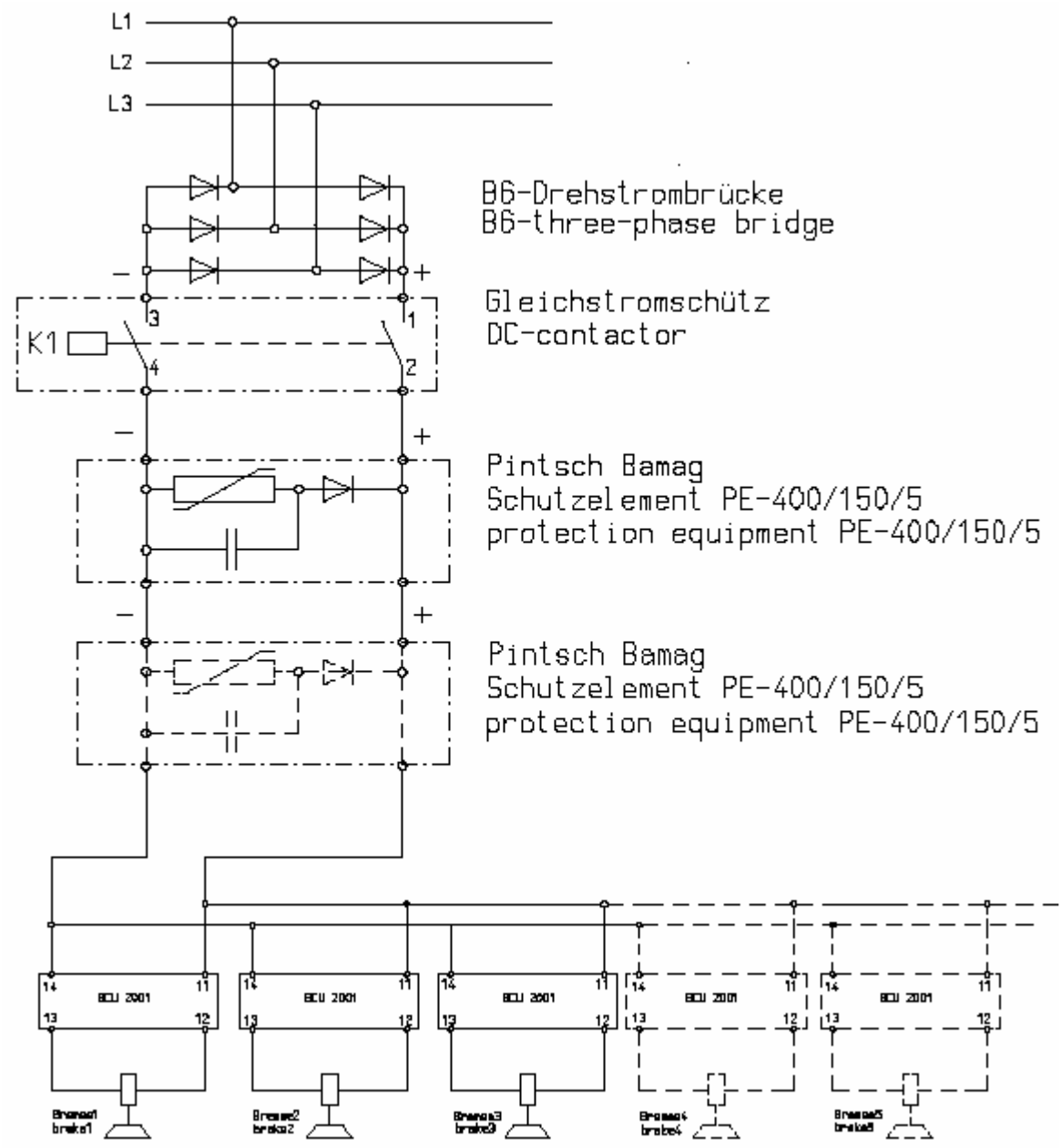

Fig. 10: *The diagram shows the parallel operation of 5 brakes with 2 protection elements*

The parallel connection of a <u>maximum of 12 brakes</u> is possible with one contactor. For the parallel connection of more than 12 brakes a further contactor is necessary. If you require further information for planning your system and this is not given here, please contact Pintsch Bamag

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6.2.2.8 Special brakes

Brakes with a greater nominal torque are recognised by additional type identification such as: KFB 40/47; SFB 16/21; SFB 25-SH.

In order to operate with special brakes Pintsch Bamag must always be contacted to clarify the DIP switch settings. The appended table of DIP switch settings on the BCU2001 cannot be used in this case.

6.2.3 Noise

Depending on the auxiliary power supply type and level, a soft, chirping noise can be produced.
.

6.2.4 Incorrect use

The BCU 2001 is not suitable for the following applications:

- Operation with the brakes of other manufacturers
- Operation in domestic, trading and commercial buildings.
- Operation in rooms exposed to potentially explosive or flammable gases, fumes, solid materials, dust particles or liquids.
- Operation in damp or wet rooms.
- Operation outdoors.
- Operation underground
- Operation on systems exposed to direct lightening strike without protection.
- Operation in switchgear of low, medium or high-voltage power distribution systems.
- Operation of mechanically damaged equipment.
- Operation of opened equipment.
- Operation without external over voltage protection.
- Operation in rooms subject to electrically conductive dust atmospheres.
- Operation in rooms in which food is produced or processed.
- Operation in hygiene areas of hospitals.
- Operation of several brakes on one BCU.
- Operation to monitor brakes which are rapidly activated with triple coil voltage
- Operation in proposed switchgear other than described in these operating instructions.

7 Operation

7.1 Adjustment

Provided on the underside of the BCU 2001 is the 8-pole DIP switch S1 (fig. 8). This switch can be used to adjust the BCU to the employed brake.
For commissioning the BCU 2001, the rated current must be read off the brake rating plate. Using table 4 (5A version) or table 5 (20A version) set out in the appendix the setting of DIP switch S1 can be determined.

If the rated current on the rating plate does not correspond clearly with the value in the table the next highest value in the table applies.

∆ Interrupt supply voltage

Interrupt the operating voltage of the auxiliary power supply and the brake circuit (see Section “General safety information”).

- The switches can be adjusted with a small, pointed object as listed in the following table for the employed brake. Care must be taken not to damage the device mechanically.

This work must also be carried out when in an existing system a brake is replaced with a brake of a different type.

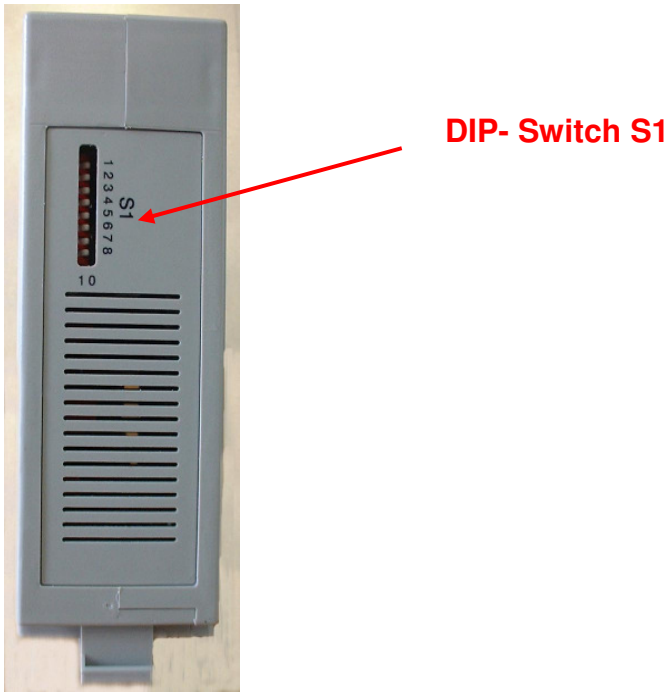

Fig. 11: *Underside of BCU 2001 with coding switcher (DIP switch S1)*

Brakes with special equipment, e.g. mounting option for a tachogenerator, emergency release lever, etc., are to be treated in the same way as the basic variants.

Service

If in doubt, Pintsch Bamag should be contacted.

7.2 Deviation from the maximum air gap

When commissioning the BCU 2001, the maximum air gap can deviate from the value shown on the rating plate. This deviation of the maximum air gap from the value on the rating plate is **not a malfunction** of the BCU 2001. In this case, the BCU 2001 calculates the actual brake conditions, so that the maximum air gap monitoring function is maintained.

7.3 Actions during operation

There are no specific actions to be taken during operation. Only in the event of a fault must the resetting button be actuated following fault clearance to reset the fault signal. This can also be done by briefly interrupting the auxiliary voltage supply to the electronics.

7.4 Functional test of the wear evaluation

The correct function of the wear evaluation can be checked by the following DIP switches S1 setting.

DIP switch S1

1	2	3	4	5	6	7	8	
0	0	0	0	0	0		0	0
						1		1

If the blue LED is indicated after turning on the brake, the device is all right.

After the functional test S1setting must be respected to the correct setting of the previous DIP switches.

8 Technical data

	IEC/EN	
Maximum permissible rated voltage of supply system in rectifier operation	**440 Veff**	
Maximum permissible rated coil voltage	**DC 396 V**	
Maximum permissible rated coil voltage with one-way rectification	**DC 198 V**	
Minimum permissible rated coil voltage	**DC 24V V**	
Maximum permissible continuous coil current	**5.0 A (*20A)*[◊]**	
Minimum permissible rated coil current	**0.2 A *(2A)*[◊]**	
Maximum permissible rated coil current (at 20°C)	**5.70 A *(22.80)*[◊]**	
Number of operating current setting levels	**255**	
Current evaluation measuring error at 1A (4A)* coil current	**< 5%**	
Permissible rated voltage of auxiliary power	**24V AC -15% ... 230V AC +15%** **24V DC -25% ... 110V DC +15%** [1]	
External fuse rating for auxiliary supply	**max. 20A**	
Maximum power consumption	**10W/10VA**	
Inrush current	**DC 24V / <1,7A / 1ms** **AC 230V / <15A / 1ms**	
Max. power consumption	**10 W / 10 VA**	
Relay contact rating	**230V AC/2A** **24V DC/5A** **110V DC/0.3A**	
Relay response time for “brake released” signal	**< 100ms**	
Permissible cross-section of connecting cables for auxiliary power and relay contacts	**0.2 ... 2.5 mm²**	**WG 24 ... 14**
Tightening torque	**0.4Nm**	**5-7 lb in.**
Wire type	**Copper**	
UG	**B, D**	
CA	**2 (105), 4#**	
Permissible cross section of connecting cable for brake circuit	**0.5 ... 4.0 mm²**	**WG 20 ... 10**

[◊] ***The values shown in brackets refer to the BCU 2001-20A***
[1] ***The operation is recommended with DC 24 V***

Tightening torque	**0.5 Nm**	**6.5-7 lb in.**
Wire type	**Copper**	
UG	**B, D**	
CA	**2 (105), 4**	
Continuous permissible ambient temperature	**-40°C ... +50°C**	
Weight	**0.4 kg**	
Test voltage	**2kV AC/1 min/50 Hz**	
Insulation resistance[1]	**> 100MΩ**	
Degree of protection	**IP 20**	
Protection class	**II**	

If the ambient conditions or other parameters should deviate from your requirements, please contact Pintsch Bamag or its representative

9 Appendix

Table for setting the DIP- switch in the BCU 2001 (5A version)																
Coil current	***Coding switch number***								**Coil current**	***Coding switch number***							
[A]	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	**[A]**	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***
0.25	0	0	0	0	I	0	I	I	**1.32**	0	0	I	I	I	0	I	I
0.27	0	0	0	0	I	I	0	0	**1.34**	0	0	I	I	I	I	0	0
0.29	0	0	0	0	I	I	0	I	**1.36**	0	0	I	I	I	I	0	I
0.31	0	0	0	0	I	I	I	0	**1.38**	0	0	I	I	I	I	I	0
0.33	0	0	0	0	I	I	I	I	**1.41**	0	0	I	I	I	I	I	I
0.36	0	0	0	I	0	0	0	0	**1.43**	0	I	0	0	0	0	0	0
0.38	0	0	0	I	0	0	0	I	**1.45**	0	I	0	0	0	0	0	I
0.40	0	0	0	I	0	0	I	0	**1.47**	0	I	0	0	0	0	I	0
0.42	0	0	0	I	0	0	I	I	**1.50**	0	I	0	0	0	0	I	I
0.45	0	0	0	I	0	I	0	0	**1.52**	0	I	0	0	0	I	0	0
0.47	0	0	0	I	0	I	0	I	**1.54**	0	I	0	0	0	I	0	I
0.49	0	0	0	I	0	I	I	0	**1.56**	0	I	0	0	0	I	I	0
0.51	0	0	0	I	0	I	I	I	**1.59**	0	I	0	0	0	I	I	I
0.54	0	0	0	I	I	0	0	0	**1.61**	0	I	0	0	I	0	0	0
0.56	0	0	0	I	I	0	0	I	**1.63**	0	I	0	0	I	0	0	I
0.58	0	0	0	I	I	0	I	0	**1.65**	0	I	0	0	I	0	I	0
0.60	0	0	0	I	I	0	I	I	**1.68**	0	I	0	0	I	0	I	I
0.63	0	0	0	I	I	I	0	0	**1.70**	0	I	0	0	I	I	0	0
0.65	0	0	0	I	I	I	0	I	**1.72**	0	I	0	0	I	I	0	I
0.67	0	0	0	I	I	I	I	0	**1.74**	0	I	0	0	I	I	I	0
0.69	0	0	0	I	I	I	I	I	**1.76**	0	I	0	0	I	I	I	I
0.71	0	0	I	0	0	0	0	0	**1.79**	0	I	0	I	0	0	0	0
0.74	0	0	I	0	0	0	0	I	**1.81**	0	I	0	I	0	0	0	I
0.76	0	0	I	0	0	0	I	0	**1.83**	0	I	0	I	0	0	I	0
0.78	0	0	I	0	0	0	I	I	**1.85**	0	I	0	I	0	0	I	I
0.80	0	0	I	0	0	I	0	0	**1.88**	0	I	0	I	0	I	0	0
0.83	0	0	I	0	0	I	0	I	**1.90**	0	I	0	I	0	I	0	I
0.85	0	0	I	0	0	I	I	0	**1.92**	0	I	0	I	0	I	I	0
0.87	0	0	I	0	0	I	I	I	**1.94**	0	I	0	I	0	I	I	I
0.89	0	0	I	0	I	0	0	0	**1.97**	0	I	0	I	I	0	0	0
0.92	0	0	I	0	I	0	0	I	**1.99**	0	I	0	I	I	0	0	I
0.94	0	0	I	0	I	0	I	0	**2.01**	0	I	0	I	I	0	I	0
0.96	0	0	I	0	I	0	I	I	**2.03**	0	I	0	I	I	0	I	I
0.98	0	0	I	0	I	I	0	0	**2.06**	0	I	0	I	I	I	0	0
1.00	0	0	I	0	I	I	0	I	**2.08**	0	I	0	I	I	I	0	I
1.03	0	0	I	0	I	I	I	0	**2.10**	0	I	0	I	I	I	I	0
1.05	0	0	I	0	I	I	I	I	**2.12**	0	I	0	I	I	I	I	I
1.07	0	0	I	I	0	0	0	0	**2.14**	0	I	I	0	0	0	0	0
1.09	0	0	I	I	0	0	0	I	**2.17**	0	I	I	0	0	0	0	I
1.12	0	0	I	I	0	0	I	0	**2.19**	0	I	I	0	0	0	I	0
1.14	0	0	I	I	0	0	I	I	**2.21**	0	I	I	0	0	0	I	I
1.16	0	0	I	I	0	I	0	0	**2.23**	0	I	I	0	0	I	0	0
1.18	0	0	I	I	0	I	0	I	**2.26**	0	I	I	0	0	I	0	I
1.21	0	0	I	I	0	I	I	0	**2.28**	0	I	I	0	0	I	I	0
1.23	0	0	I	I	0	I	I	I	**2.30**	0	I	I	0	0	I	I	I
1.25	0	0	I	I	I	0	0	0	**2.32**	0	I	I	0	I	0	0	0
1.27	0	0	I	I	I	0	0	I	**2.35**	0	I	I	0	I	0	0	I
1.29	0	0	I	I	I	0	I	0	**2.37**	0	I	I	0	I	0	I	0

Table for setting the DIP- switch in the BCU 2001 (5A version)

Coil current	Coil current								Coil current	Coil current							
[A]	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	[A]	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
2.39	0	I	I	0	I	0	I	I	3.35	I	0	0	I	0	I	I	0
2.41	0	I	I	0	I	I	0	0	3.37	I	0	0	I	0	I	I	I
2.43	0	I	I	0	I	I	0	I	3.40	I	0	0	I	I	0	0	0
2.46	0	I	I	0	I	I	I	0	3.42	I	0	0	I	I	0	0	I
2.48	0	I	I	0	I	I	I	I	3.44	I	0	0	I	I	0	I	0
2.50	0	I	I	I	0	0	0	0	3.46	I	0	0	I	I	0	I	I
2.52	0	I	I	I	0	0	0	I	3.49	I	0	0	I	I	I	0	0
2.55	0	I	I	I	0	0	I	0	3.51	I	0	0	I	I	I	0	I
2.57	0	I	I	I	0	0	I	I	3.53	I	0	0	I	I	I	I	0
2.59	0	I	I	I	0	I	0	0	3.55	I	0	0	I	I	I	I	I
2.61	0	I	I	I	0	I	0	I	3.57	I	0	I	0	0	0	0	0
2.64	0	I	I	I	0	I	I	0	3.60	I	0	I	0	0	0	0	I
2.66	0	I	I	I	0	I	I	I	3.62	I	0	I	0	0	0	I	0
2.68	0	I	I	I	I	0	0	0	3.64	I	0	I	0	0	0	I	I
2.70	0	I	I	I	I	0	0	I	3.66	I	0	I	0	0	I	0	0
2.72	0	I	I	I	I	0	I	0	3.69	I	0	I	0	0	I	0	I
2.75	0	I	I	I	I	0	I	I	3.71	I	0	I	0	0	I	I	0
2.77	0	I	I	I	I	I	0	0	3.73	I	0	I	0	0	I	I	I
2.79	0	I	I	I	I	I	0	I	3.75	I	0	I	0	I	0	0	0
2.81	0	I	I	I	I	I	I	0	3.78	I	0	I	0	I	0	0	I
2.84	0	I	I	I	I	I	I	I	3.80	I	0	I	0	I	0	I	0
2.86	I	0	0	0	0	0	0	0	3.82	I	0	I	0	I	0	I	I
2.88	I	0	0	0	0	0	0	I	3.84	I	0	I	0	I	I	0	0
2.90	I	0	0	0	0	0	I	0	3.86	I	0	I	0	I	I	0	I
2.93	I	0	0	0	0	0	I	I	3.89	I	0	I	0	I	I	I	0
2.95	I	0	0	0	0	I	0	0	3.91	I	0	I	0	I	I	I	I
2.97	I	0	0	0	0	I	0	I	3.93	I	0	I	I	0	0	0	0
2.99	I	0	0	0	0	I	I	0	3.95	I	0	I	I	0	0	0	I
3.02	I	0	0	0	0	I	I	I	3.98	I	0	I	I	0	0	I	0
3.04	I	0	0	0	I	0	0	0	4.00	I	0	I	I	0	0	I	I
3.06	I	0	0	0	I	0	0	I	4.02	I	0	I	I	0	I	0	0
3.08	I	0	0	0	I	0	I	0	4.04	I	0	I	I	0	I	0	I
3.11	I	0	0	0	I	0	I	I	4.07	I	0	I	I	0	I	I	0
3.13	I	0	0	0	I	I	0	0	4.09	I	0	I	I	0	I	I	I
3.15	I	0	0	0	I	I	0	I	4.11	I	0	I	I	I	0	0	0
3.17	I	0	0	0	I	I	I	0	4.13	I	0	I	I	I	0	0	I
3.19	I	0	0	0	I	I	I	I	4.15	I	0	I	I	I	0	I	0
3.22	I	0	0	I	0	0	0	0	4.18	I	0	I	I	I	0	I	I
3.24	I	0	0	I	0	0	0	I	4.20	I	0	I	I	I	I	0	0
3.26	I	0	0	I	0	0	I	0	4.22	I	0	I	I	I	I	0	I
3.28	I	0	0	I	0	0	I	I	4.24	I	0	I	I	I	I	I	0
3.31	I	0	0	I	0	I	0	0	4.27	I	0	I	I	I	I	I	I
3.33	I	0	0	I	0	I	0	I	4.29	I	I	0	0	0	0	0	0

Table for setting the DIP- switch in the BCU 2001 (5A version)																
Coil current	Coil current								Coil current	Coil current						
[A]	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	[A]	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
4.31	I	I	0	0	0	0	0	I	5.23	I	I	I	0	I	0	I	0
4.33	I	I	0	0	0	0	I	0	5.25	I	I	I	0	I	0	I	I
4.36	I	I	0	0	0	0	I	I	5.27	I	I	I	0	I	I	0	0
4.38	I	I	0	0	0	I	0	0	5.29	I	I	I	0	I	I	0	I
4.40	I	I	0	0	0	I	0	I	5.32	I	I	I	0	I	I	I	0
4.42	I	I	0	0	0	I	I	0	5.34	I	I	I	0	I	I	I	I
4.45	I	I	0	0	0	I	I	I	5.36	I	I	I	I	0	0	0	0
4.47	I	I	0	0	I	0	0	0	5.38	I	I	I	I	0	0	0	I
4.49	I	I	0	0	I	0	0	I	5.41	I	I	I	I	0	0	I	0
4.51	I	I	0	0	I	0	I	0	5.43	I	I	I	I	0	0	I	I
4.54	I	I	0	0	I	0	I	I	5.45	I	I	I	I	0	I	0	0
4.56	I	I	0	0	I	I	0	0	5.47	I	I	I	I	0	I	0	I
4.58	I	I	0	0	I	I	0	I	5.50	I	I	I	I	0	I	I	0
4.60	I	I	0	0	I	I	I	0	5.52	I	I	I	I	0	I	I	I
4.62	I	I	0	0	I	I	I	I	5.54	I	I	I	I	I	0	0	0
4.65	I	I	0	I	0	0	0	0	5.56	I	I	I	I	I	0	0	I
4.67	I	I	0	I	0	0	0	I	5.58	I	I	I	I	I	0	I	0
4.69	I	I	0	I	0	0	I	0	5.61	I	I	I	I	I	0	I	I
4.71	I	I	0	I	0	0	I	I	5.63	I	I	I	I	I	I	0	0
4.74	I	I	0	I	0	I	0	0	5.65	I	I	I	I	I	I	0	I
4.76	I	I	0	I	0	I	0	I	5.67	I	I	I	I	I	I	I	0
4.78	I	I	0	I	0	I	I	0	5.70	I	I	I	I	I	I	I	I
4.80	I	I	0	I	0	I	I	I									
4.83	I	I	0	I	I	0	0	0									
4.85	I	I	0	I	I	0	0	I									
4.87	I	I	0	I	I	0	I	0									
4.89	I	I	0	I	I	0	I	I									
4.92	I	I	0	I	I	I	0	0									
4.94	I	I	0	I	I	I	0	I									
4.96	I	I	0	I	I	I	I	0									
4.98	I	I	0	I	I	I	I	I									
5.00	I	I	I	0	0	0	0	0									
5.03	I	I	I	0	0	0	0	I									
5.05	I	I	I	0	0	0	I	0									
5.07	I	I	I	0	0	0	I	I									
5.09	I	I	I	0	0	I	0	0									
5.12	I	I	I	0	0	I	0	I									
5.14	I	I	I	0	0	I	I	0									
5.16	I	I	I	0	0	I	I	I									
5.18	I	I	I	0	I	0	0	0									
5.21	I	I	I	0	I	0	0	I									

Table 4: *Setting the DIP switch S1 of the BCU 2001 (5A version) for normal activation*

Table for setting the DIP switch in the BCU 2001 (20A version)								
Coil current [A]	*Coding switch number*							
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
5,71	0	I	0	0	0	0	0	0
6,1	0	I	0	0	0	I	0	0
6,92	0	I	0	0	I	I	0	0
7,7	0	I	0	I	0	I	I	0
8,17	0	I	0	I	I	I	0	0
12,2	I	0	0	0	I	0	0	I
12,8	I	0	0	I	0	0	0	0
17,1	I	I	0	0	0	0	0	0

Table 5: *Setting the DIP switch S1 of the BCU 2001 (20A version) for normal activation*

For current values not listed in table 2 please contact Pintsch Bamag or its representative before commissioning the BCU 2001 20A version in order to clarify the necessary settings (DIP switch)

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